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# Grade 8 & 9 Numeracy

## Session 2

November 2018

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# Agenda

- Recap of new curriculum and growth mindset
- Number Talks
- Math through an Indigenous Lens
- Lesson sequences: Pythagorean's Theorem & Proportional Reasoning
- Online Resource Exploration

# Session Goals

- To continue to deepen our understanding of the new math curriculum
- To explore worldviews and teaching practices that can more inclusive for all learners

# Introduce Yourself

Self - Location: What is your personal and family history that brought you to this land?

## Share...

Something that you tried in your classes from last session, or something that has been working well in your classes

# New Math Curriculum

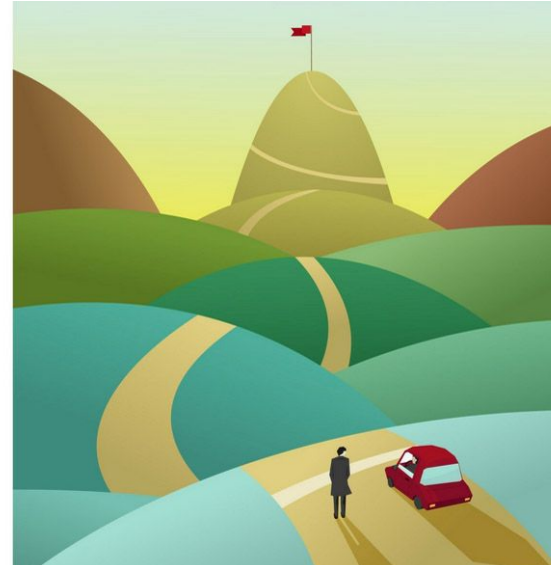
- Focus on skills and processes as much as content
- All areas of learning are based on a “Know-Do-Understand” model to support a **concept-based competency-driven** approach to learning.
- Three elements, the Content (Know), Curricular Competencies (Do), and Big Ideas (Understand) all work together to support deeper learning.

# An Analogy

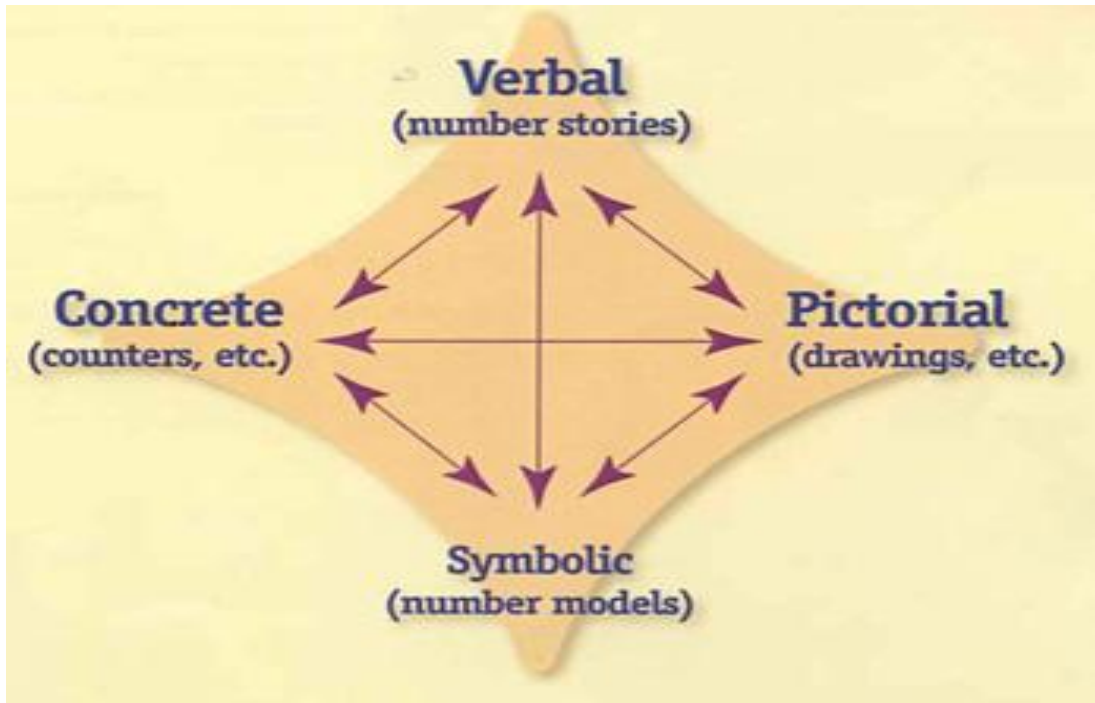
The Curricular competencies are the vehicle

The Curricular content are the passengers

The Big Ideas are the destination



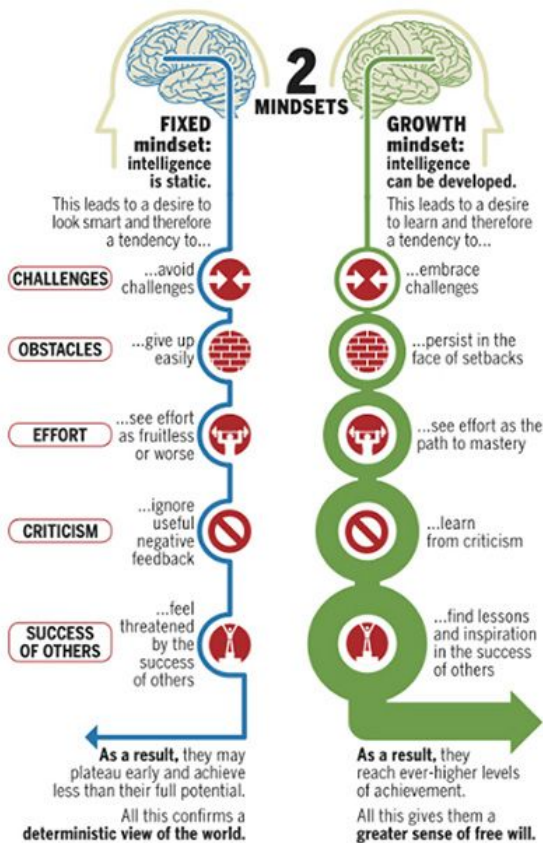
# Multi-Dimensional Mathematics



Math concepts are explored and understood in all of these ways to improve engagement, meaning and conceptual understanding



# Growth Mindset

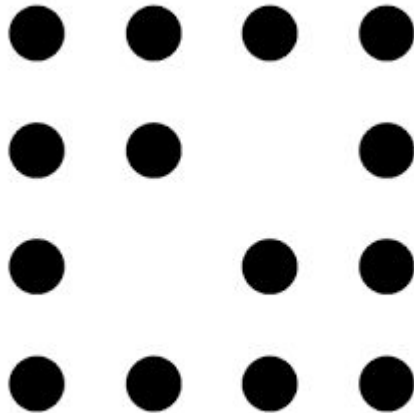


# Growth Mindset Videos

<https://www.youtube.com/watch?v=75GFzikmRY0>

<https://www.youtube.com/watch?v=cgLYkV689s4>

# Number Talk



## Number String

$$24 \div 2 =$$

$$24 \div 4 =$$

$$24 \div 8 =$$

$$120 \div 8 =$$

# Begin at the Beginning

I HIGHLY recommend this course:

<http://pdce.educ.ubc.ca/Reconciliation/>

Next registration is January and could be done as a PLC or individually.

# Self Location

What is your personal and family history that brought you to this land?

Are you aware of the history of the land you live and work on?

Were your family or ancestors impacted by colonization, oppression, structural violence, or war?

What is your understanding of the impacts of colonial violence against Indigenous communities?

What does reconciliation mean to you?

# Indigenous Worldviews

Indigenous Worldviews are reflected in the First Peoples Principles of Learning. Start with ONE and think about it, try it out in different ways.

Some things to consider:

How can we build respectful relationships with our students and their families?

How many visuals versus symbolic representations are used/explored?

How can storytelling be incorporated into math classes?

How can we learn on and from the land more?

How can we find the strengths in each student?





# Lesson Sequence 1: Pythagorean Theorem

Goals: To understand the Pythagorean Theorem by using visual models

# Accessing Prior Knowledge

1) Determine which of the following are square numbers and prove that they are square visually and symbolically:

9, 12, 16, 20

2) Estimate the square root of the following and explain your estimate:

10, 30, 35

3) What is a right angled triangle? Draw some examples and non-examples to help you explain your definition

4) Ensure they know what the hypotenuse is

# Processing

<http://asp.tumblebooks.com/ViewOnline.aspx?ls5=false&ProductID=5244>

Story telling is at the root of Indigenous teachings and it's also a great hook to spark curiosity as well as to connect to applications of math

Read the first 19 pages and then ask students to find the triangle that makes a right angle using the knoted rope or you could use square tiles and have each tile represent one section of the rope

# Processing

Read the next two pages and then explore, using the square tiles (or grid paper), make the pattern that he does around the 3,4,5 triangle.

Explore this some more: ask students to use their tiles to see what other triangles they can make using their tiles (only the Pythagorean Triples will be possible). Write their results in the chart.

Expand by using grid paper to create any RIGHT angles triangle they want and makes squares off the sides and write their results on the board (some will need help actually making

Teacher note: put a chart on the board that students will fill out with these headings: Side length A, Side length B, Side length C (hypotenuse), Square of A, Square of B, Square of C

# Processing

Ask students to see if they can figure out the pattern, rule or theorem that we call Pythagorean's Theorem.

Now apply it: provide students with some right triangles with one missing side and ask them to determine the missing side using the theorem and then they can check it using grid paper and a ruler

Return to the book:

Read the next 9 pages but cover the 5,12,13 triangle and give them the problem of: the height of the roof is 12 feet and the ladder should be 5 feet away from the wall for safety, how long of a ladder do we need to reach the roof?

# Processing

Read the next 6 pages and give them the information for sailing from Samos to Crete by using the following information:



# Processing

Finish the story to see if you found the same distance as Pythagoras.

# Transforming

Students can solve a variety of problems including:

Pictorial

Contextual

Symbolic



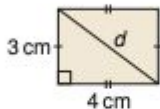
9. Find the length of the diagonal,  $d$ , in each rectangle.

What patterns do you notice?

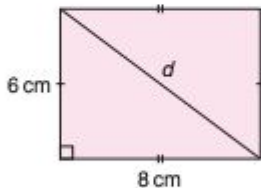
Write to explain.

Use your patterns to draw the next rectangle in the pattern.

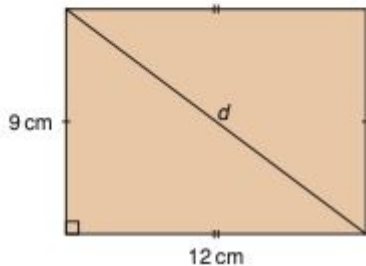
a)



b)



c)



12. **Assessment Focus** The hypotenuse of a right triangle is  $\sqrt{18}$  units.

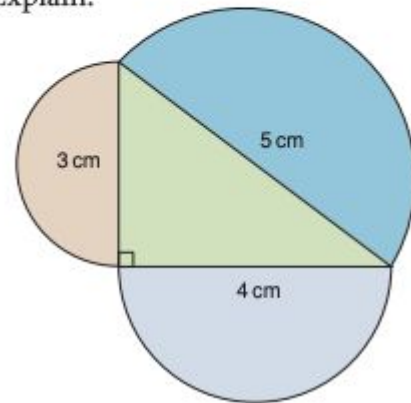
What are the lengths of the legs of the triangle?

How many different answers can you find?

Sketch a triangle for each answer.

Explain your strategies.

16. **Take It Further** An artist designed this logo. It is a right triangle with a semicircle drawn on each side of the triangle. Calculate the area of each semicircle. What do you notice? Explain.



From: Math Makes Sense 8

# Assessment/Journal

Explain Pythagorean's Theorem as if you were teaching it to a classmate. Use examples, words, pictures and symbols in your explanation. Include contexts where we would use Pythagorean's Theorem

# Reflection

How did using the grid paper and tiles affect your understanding of Pythagorean's Theorem?

What are you finding challenging about using Pythagorean's Theorem?

What do you find easiest about using the theorem?

Explain a mistake that occurred today that helped you to better understand the theorem.

# Lesson Sequence 2: Proportional Reasoning

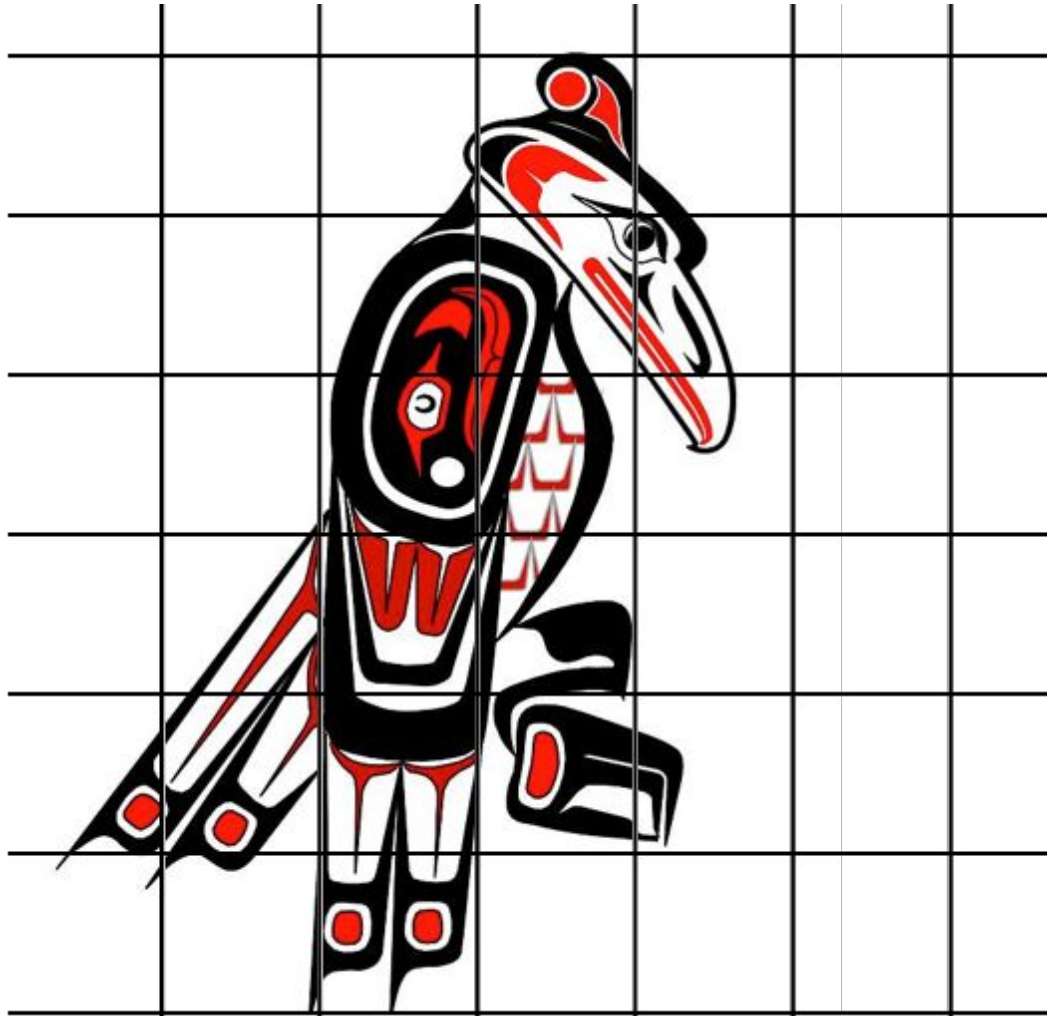
Goal: To understand how to use proportions, including similar triangles to find unknown heights of objects too tall to measure easily (like trees).

Note: I would do this lesson after exploring scale - I've included an idea for scale that I presented in April (Session 4)

# Aboriginal Connections cont'd

Murals with Scale Drawings (Gr. 9):

Start with using a piece of Aboriginal Art (that has permission to reproduce and use for this activity) and section it into equal sized small squares and then number the back and give each student their square or two and they need to enlarge it to whatever scale you choose. Then you can piece the enlarged images together to create a larger version of the original art (this is how they do large murals). Glue the tiny paper to the larger version so they don't get lost and teacher records the number each student has so it can be put together easily.



# Accessing Prior Knowledge

Connect similar triangles to similar shapes or enlargements/scale and ask students to discuss in their groups the following:

What does it mean if something is 'to scale' or is a similar shape? Provide an example using pictures, words and numbers.

Predict what you think similar triangles are - provide an example using a picture, words and numbers.

What does proportional mean? Give provide at least one example.

# Processing

We are going to explore 3 methods for finding estimating the hieght of a tree (although one requires a sunny day). All methods involve proportional reasoning. Please refer to the handout 'Estimating Heights of Trees' for the instructions.

I used the information from these two sources:

<https://nrich.maths.org/2434>

<https://www.mcgill.ca/redpath/files/redpath/Trees.And.Math.pdf>



# Explore Through an Indigenous Lens

There are many things to learn about trees...

How do we use and connect with trees?

How do trees connect with each other?

We're going to focus on one aspect: height!

How do we know how tall a tree is? Do we include roots and crowns?

Why might it matter how tall a tree is?

Why not just measure the height of the tree with a measuring tape?

Sample Answers:

Building: totems, canoes, long houses, logging

If you want to learn more about how trees talk to each other:

[https://www.ted.com/talks/suzanne\\_simard\\_how\\_trees\\_talk\\_to\\_each\\_other?language=en](https://www.ted.com/talks/suzanne_simard_how_trees_talk_to_each_other?language=en)

# Transforming

Students can solve similar measurement problems using photos, contexts, drawings, etc.

Students can also be solving proportional problems

There is also a 3 Act Task that you could use:

<https://tapintoteenminds.com/3act-math/giant-rubber-duck/>

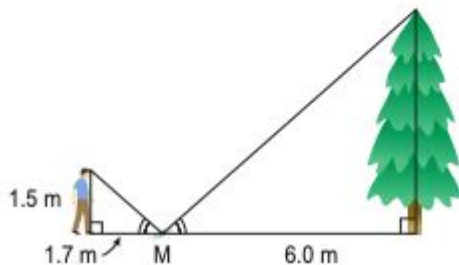
**12. Assessment Focus** Use grid paper.

Construct rectangles with these dimensions:  
3 units by 4 units, 6 units by 8 units,  
9 units by 12 units, and 12 units by  
15 units

- a) i) Which rectangle is not similar to the other rectangles?  
Explain your reasoning.
- ii) Draw two different rectangles that are similar to this rectangle.  
Show your work.
- b) The diagonal of the smallest rectangle has length 5 units. Use proportions to calculate the lengths of the diagonals of the other two similar rectangles.

**Take It Further**

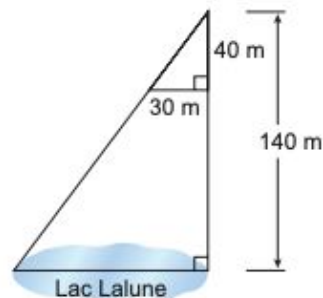
- 13.** Phillippe places a mirror M on the ground 6.0 m from a tree. When he is 1.7 m from the mirror, he can see the top of the tree in the mirror. His eyes are 1.5 m above the ground. The diagram below shows the equal angles. How can you use similar triangles to determine the height of the tree to the nearest tenth of a metre?



- 10.** When the shadow of a building is 16 m long, a 4-m fence post casts a shadow 3 m long.

- a) Sketch a diagram.  
b) How tall is the building?

- 11.** This scale diagram shows the measurements a surveyor made to determine the length of Lac Lalune. What is this length?  
How do you know?



# Reflections

What method of measuring the height of the tree did you like best? Why?

Which do you think is the most accurate? Why?

What part did you find the most challenging?

How did you learn from others in today's class?

What did you do in today's class that supported someone's learning?

How could we use this idea to solve other problems?

# Routines/Strategies

Formative Assessment = Minute by Minute - What do they 'get' and 'not get'

- Accountability sticks
- Questioning the answers 'basketball' technique
- Individual white boards/pouches
- Thumbs up/side/down
- Think-Pair-Share
- Daily Reflections on learning - last 5-7 minutes ( or homework)
- Journals - formative feedback only about 2 times a week
- Ticket out the door - into piles of "got it", "kind of", "not yet"

# Numeracy Routines Similar to Number Talks

Splat: <https://www.stevewyborney.com/?p=893>

Which One Doesn't Belong: <http://wodb.ca/>

Would you Rather: <http://www.wouldyourathermath.com/>

Estimation 180: [www.estimated180.com](http://www.estimated180.com)

# Depth of Knowledge 2-3 Resources

Use Robert Kaplinsky's custom search engine:

<http://robertkaplinsky.com/prbl-search-engine/>

Open Middle Tasks:

<http://www.openmiddle.com/>

3 Act Tasks:

[https://docs.google.com/a/sd61learn.ca/spreadsheets/d/1jXSt\\_CoDzyDFeJimZxnHgW0VsWkTQEsfqouLWNNC6Z4/pub?output=html](https://docs.google.com/a/sd61learn.ca/spreadsheets/d/1jXSt_CoDzyDFeJimZxnHgW0VsWkTQEsfqouLWNNC6Z4/pub?output=html)

<https://tapintoteenminds.com/3act-math/>



# Making Your Own DOK 2/3

In resources like Math Makes Sense, DOK 2&3 are often the last questions in the section. Any contextualized problems can also be made into DOK 2 or 3 by making small changes such as:

- Take out some details, or information so that there are more than one right answer or a range of answers
- Require students to estimate, model, write to explain their process of solving
- Give students the answer and ask them for the question(s)

# Assessing

Consider using rubrics. These are relevant for Grade 9:

<https://www.lskysd.ca/ProgramsLearning/curriculumconnections/CurricularSupports/gradenine/Documents/Grade%209%20Math%20Rubrics.docx>

[https://curriculum.gov.bc.ca/sites/curriculum.gov.bc.ca/files/pdf/Grad\\_Numeracy\\_Scoring\\_Guide\\_and\\_Student\\_Exemplars.pdf](https://curriculum.gov.bc.ca/sites/curriculum.gov.bc.ca/files/pdf/Grad_Numeracy_Scoring_Guide_and_Student_Exemplars.pdf)

<https://www.srsd119.ca/departments/teacherinformation/ILD/Supporting%20Documents/Grade9MathRubrics.pdf>

# More Rubrics

These are for Grade 8:

<https://www.pearsoncanadaschool.com/index.cfm?locator=PS1g9e&PMDBSOLUTIONID=25862&PMDBSITEID=2621&PMDBCATEGORYID=25876&PMDBSUBSOLUTIONID=&PMDBSUBJECTAREAID=&PMDBSUBCATEGORYID=&PMDBProgramID=47168&elementType=asset&elementID=Custom%20Bucket%201>

<https://www.lskysd.ca/ProgramsLearning/CurriculumAndInstruction/Assessment/LSKYAssessment/Rubrics/Documents/Grade%208%20Math%20Rubrics.docx>



## Subject: Grade 9 Math, Shape and Space Strand

**Outcome: SS9.3 – I can demonstrate understanding of similarity of 2-D shapes.**

<b>Beginning – 1 I need help.</b>	<b>Approaching – 2 I have a basic understanding.</b>	<b>Proficiency – 3 My work consistently meets expectations.</b>	<b>Mastery – 4 I have a deeper understanding.</b>
With assistance I can observe and describe similar 2-D shapes. With assistance I can draw a polygon similar to a simple polygon. With assistance I can identify situations that involve scale diagrams.	I can observe and describe similar 2-D shapes. I can draw a polygon similar to a simple polygon. I can identify situations that involve scale diagrams.	I can independently draw a polygon similar to a given polygon. I can identify and describe situations that involve scale diagrams. I can independently draw a diagram to scale.	I can verify whether or not two polygons are similar. I can draw a polygon similar to a given polygon and explain the strategies used. I can describe situations that involve scale diagrams and explain the meaning of the scale factor involved.

**Indicators – please select and assess as appropriate to your unit, bold text indicates possible key indicators.**

- Observe and describe 2-D shapes, relevant to self, family, or community, that are similar.
- Explain the difference between similarity and congruence of polygons.
- **Verify whether or not two polygons are similar.**
- **Explain how ratios and proportionality are related to similarity of polygons.**
- Draw a polygon similar to a given polygon and explain the strategies used.
- **Solve situational questions involving the similarity of polygons.**
- Identify and describe situations relevant to self, family, or community that involve scale diagrams and explain the meaning of the scale factor involved.
- **Explain how scale diagrams are related to similarity, ratios, and proportionality.**
- Draw a diagram to scale that represents an enlargement or reduction of a given 2-D shape and explain the strategies used.
- Explain how to determine the scale factor for a given 2-D shape and an enlargement or reduction of the shape.
- Verify whether or not a given diagram is a scale diagram of a 2-D shape and, if it is, identify the scale factor for the diagram.
- Solve situational questions involving scale diagrams and scale factors.

# Exemplars

Check out this task, with possible solutions and exemplars to see how to use a rubric:

<https://www.exemplars.com/education-materials/free-samples/math-9-12>

# Reflection and Action Plan

“If you don’t use it, you lose it”

Action Plan:

- What are you going to implement this week?

Feedback sheets for reflections please...